

TRAFFIC LIGHT LED FAULT MONITORING AND DETECTION SYSTEM

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Special dedication to my beloved family and friends

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ABSTRACT

An innovative idea has been devised into a beta prototype of traffic light LED fault monitoring and detection system. The key of this project which is used LED lamps is to replace the 40-100W and 3-month lifetime tungsten bulbs by 5-15W and 30-year lifetime LED bulbs to get a large amount of energy and labor savings. This project will be supplied by solar power as the main power supplied and rechargeable battery at the night time and 240V AC as backup power. Solar traffic light is the new technology providing a reliable, inexpensive, affordable and environmentally friendly source for modern traffic management systems. As a real time application, this system will inform whereby the broken LED need to replace once the threshold level is achieved. The broken LED is detected based on current measurement. As the output of this system, the three flashed LED will light on and the LCD will display the percentage of broken LED. Besides, color blindness can be challenging as well as cumbersome for a person especially when driving a vehicle. The design of this system could help to improve the visibility of traffic light display for the road user especially the road user. This invention would be the best instantaneous solution to ensure all traffic lights are repaired immediately in making sure the road accidents at junctions are reduced dramatically.

ABSTRAK

Satu idea yang inovatif telah dirancang ke dalam prototaip beta pemantauan kerosakan dan sistem pengesanan lampu isyarat LED. Tujuan utama projek ini menggunakan lampu LED adalah untuk menggantikan 40-100W dan 3 bulan mentol tungsten seumur hidup oleh 5-15W dan 30 tahun seumur hidup LED mentol untuk mendapatkan jumlah besar tenaga dan buruh simpanan. Projek ini akan dibekalkan oleh kuasa solar sebagai kuasa utama yang dibekalkan dan bateri boleh dicas semula pada waktu malam dan 240V AC sebagai kuasa sandaran. Lampu isyarat solar adalah teknologi baru yang menyediakan sumber yang boleh dipercayai, murah dan mesra alam untuk sistem pengurusan trafik moden. Sebagai aplikasi masa nyata, sistem ini akan memberitahu di mana LED terbakar perlu ditukarganti sekali tahap minimum bagi paparan terbaik lampu isyarat dicapai. LED yang rosak dikesan berdasarkan ukuran semasa. Sebagai keluaran sistem ini, ketiga-tiga LED amaran akan menyala dan LCD akan memaparkan peratusan LED yang rosak. Selain itu, rumit bagi seseorang yang buta warna untuk membezakan warna lampu isyarat terutama ketika memandu kenderaan. Reka bentuk sistem ini dapat membantu untuk memperbaiki penglihatan paparan lampu isyarat untuk pengguna jalan raya terutamanya seorang yang buta warna. Ciptaan ini akan menjadi penyelesaian yang terbaik serta-merta untuk memastikan semua lampu isyarat yang dibaiki segera dalam memastikan kemalangan jalan raya di persimpangan dikurangkan secara mendadak.

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LIST OF ABBREVIATIONS

A	Ampere
AC	Analog Current
DC	Direct Current
GSM	Global System for Mobile Communication
LED	Light Emitting Diode
PC	Personal Computer
PCB	Printed Circuit Board
PIC	Peripheral Interface Controller
TTL	Transistor-Transistor Logic
V	Volt

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CHAPTER 1

INTRODUCTION

This chapter describes the introduction of the project which titled as Traffic Light LED fault Monitoring and Detection System. The background of this project will reveals about the traffic light, the light emitting diode (LED), color blindness to the color of traffic light and the benefit of this system. Then, this chapter also will be exposed to the problem statement, objective of this project and the scope involved.

1.1 Background



Figure 1.1: LED Traffic Light

Traffic light is very useful and important in daily path of the road user. Since people using traffic light every day, the fault of traffic light will be the critical problem for the road user. The problem such as half broken of traffic light display will disrupt the vision of the road user. This project appears with the system which will monitor the traffic light condition and detect the broken LED of the traffic light display.

Traffic light, which may also be known as stop light, traffic light lamps, traffic signals, stop-and-go lights, robots or semaphore are signaling devices positioned at road intersection, pedestrian crossing and other places that suitable to control competing flows of traffic. They assign the right of way to road users by the use of lights in standard color (Red-Amber-Green) such as in Figure 1.1. In a typically cycle, illumination of the green light allows traffic to proceed in the direction denoted, illumination of the amber light denoting if safe to, prepare to stop short of the intersection, and illumination of the red signal prohibits any traffic from proceeding.[1]

Nowadays, many types of traffic light on the intersection road such as single aspect, dual aspects, three or more aspects and pedestrian or cyclist crossing lights. Usually traffic light that can be applies to control and reduce the traffic jam at the peak time. Based on this project “Traffic Light LED Fault Monitoring and Detection System” is powered by solar power at the daytime, charging the battery for used back up at the night time and bypass to AC power supply automatically if rainy season continuously and there is no sunlight or enough battery [1]. This method of power supply used will be very effectively to reduce the cost of electricity.

Light Emitting Diode (LED) Traffic Signals have become an efficient and effective alternative to traditional incandescent signals. The two main advantages of LED signals are- very low power consumption (10 W to 22 W) and very long life, as high as 7 to 10 years. When compared with the typical energy needs of an incandescent bulb, which is 135 Watts, the savings resulting from the low energy usage of LED signals can be as high as 93%. In addition to the low energy usage, the long life of LED signals means low maintenance costs, which makes LED signals a worthwhile investment and also environment-friendly. [2]

Other benefits of LED signals include elimination of catastrophic failures. Unlike an incandescent bulb which has only one filament, an LED signal is made out of a matrix of several dozen LEDs. The signal continues to function even if several of these miniature diodes stop working. On the other hand, when the filament of an incandescent

bulb fails, the display goes dark requiring immediate replacement. Besides, LED signals are brighter compared to incandescent traffic signals, which enhance intersection safety. Furthermore, the phantom effect can be eliminated. Incandescent traffic signals use reflectors behind the bulbs. For signals on east-west approaches during morning and evening hours, all colors seem to light up when the sunrays fall directly on these signals. This problem is eliminated when LED signals are used because there are no reflectors in LED signals. [2]

According to Oxford dictionary, color blindness is the inability to distinguish certain colors under bright illumination. There are many types and degrees of color blindness. It is more accurately called color vision deficiencies. The most category of color blindness is called re-green color blindness such as protanopia, protanomaly, deuteranopia and deuteranomaly [3]. It cannot be concluded that these group of people cannot see the red or green color. They just have the difficulty in differentiating between these two colors because not all reds and greens are distinguishable. Another problem of these people, they see red and green color as yellow, orange, and beige in color. Therefore, they will confuse whether the color is the real yellow, orange and beige color or is the red and green color. The least affected color is the blue color. Many people do not consider being color blind is a serious problem [4]. This is because they still can see things in this world. In fact, color blind people are classed as disability group of people. Therefore, there is not much concern put on their situation and difficulty. Another reason is that people are concerning about the safety of these group of people especially in traffic lights recognition. Most of the researches are done in the traffic lights applications.

Urban traffic control is a major area in which Traffic Light LED Fault Monitoring and Detection System can be applied. At the local level, traffic signals are designed to manage vehicle conflicts at intersections, allocating time among the conflicting traffic streams which must share the use of the intersection. The logic is, the contractor need to do the maintenance on the traffic light and replace the broken LED to a new one at the time they feel appropriate. At a higher level, maintenance of traffic

light can be part of a broader control strategy [5]. In this case, maintenance controller is used as tools for monitoring and detecting the broken LED, either in urban or rural areas, to provide a more efficient maintenance and keep better performance to the traffic light.

The benefit of this project, it wills easier the contractor job whereby the maintenance system of the LED traffic light will be running automatically. Since this system using current based measurement, it works when the total current of LED display achieves the threshold level. In other words, when the total current drop to 70% which is the maximum level of proper display of traffic light, the three special LED will be flashed and the seven segments will display the number of broken LEDs. It will be very appropriate time to replace existing traffic light with this system if some of the conventional traffic light has half broken of LED. The outcomes will be better than only replace the LED due to the low cost in future, time saving, and maintenance system is more manageable.

1.2 Problem statement

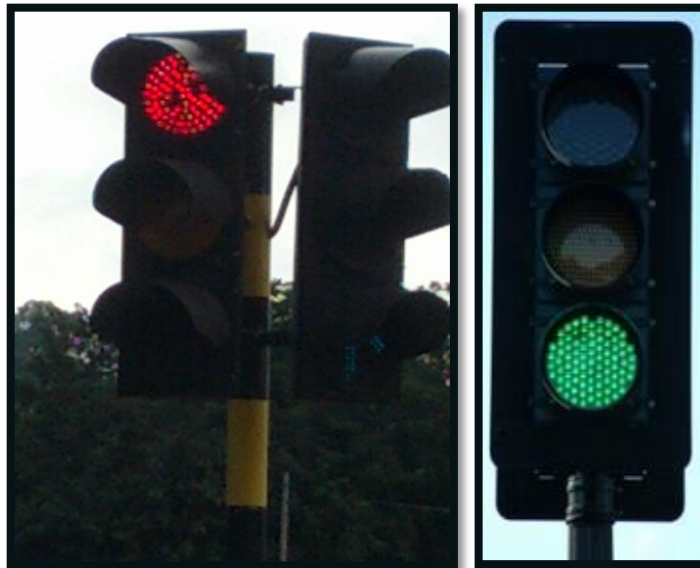


Figure 1.2: LED Traffic Light Broken

Ineffective operation and maintenance of traffic signals may have safety implications and contributes annually to millions of hours of unnecessary traffic delays, congestion, fuel consumption and air pollution. The issues associated with under staffing and underfunding traffic signal system operation and maintenance, activities are indigenous to urban, suburban and rural areas [6]. Major contributors to the inconsistency found in traffic signal operations and maintenance include a lack of detecting and replacement the broken LED of traffic light, less monitoring at the traffic light condition and inappropriate times for replacement of the broken LED. In other words, as a busy contractor they do not have much time to monitor lots of traffic light whether it in a good condition or not. This delay will create an improper display of traffic light in a long time. By having an automatically monitoring system, it wills higher the maintenance efficiency by detecting and replacing the broken LED at accurate time.

The problem in developing countries is power outages, like Malaysia which located at equator grid that has received the amounts of sunlight in monthly. This is good news for used renewable energy like solar energy to appliance work in a day. Like Russia, they have received the little amount of sunlight in monthly because the day time is shorter than night time. Therefore, Russia is the country which is not suitable to use LED traffic light based on solar power. The different between solar LED and bulb traffic light are the types of lighting element that was used. The total amount of energy usage in LED is much save than bulb and LED also much brighter than bulb. Thus, it can reduce the energy usage by using the LED as a lighting element of traffic light. [1]

In case of traffic light and color blindness, how the colors for traffic lights were selected and how color blind people are able to realize what the lights mean, even if they cannot see the colors. The most common category of color blindness is red-green color blindness which is viewed as beige color. It turns out that in the early days of the traffic light, people were concerned about this and it has mentioned by Barbara T., Los Angeles:

Who decided, back in the mists of time, that red was the color for "stop" and green the color for "go"? The commonest form of color blindness makes the colors totally useless. A warning sign that is near-invisible to a significant portion of the population strikes me as a bad idea.

Nowadays, there is color blind glasses which are the main instrument prescribed for color deficiencies people [4]. The function of these glasses is a very simple way of filtering the colors to help them to differentiate certain specific colors such as red and green color. Although these glasses seem like can be easily helping them to see the colors, it can cause other color confusion. Another alternative which is more effective in case of traffic light is upgrading the design of radial traffic light into the different shape. This method indirectly may improve their visibility and easier them to differentiate the signal of traffic light.

1.3 Objectives

The main objectives of the project are:

- a) To design and develop an embedded system which is completed with fault monitoring and detection of broken LED based on current measurement for traffic light application.
- b) To improve the traffic light power supply by using solar power and provide efficient backup power supply which are DC and AC.
- c) To upgrade the design of conventional traffic light and replace it with more effective display for the road user especially color blindness people.

1.4 Scopes

In order to achieve the objectives of the project, there are several scope had been outlined. The scope of this project includes using:

- a) In this project, the type of lighting element for traffic light display is limited to Light Emitting Diode (LED) only.
- b) Using current based detection which has IC based current sensor (ACS712) as the input and the output of this system consisting of three flashed LED and LCD display.
- c) Power supplies which will be used are solar panel, rechargeable battery 12V and 240 V AC.
- d) Solar panel placed on the top of the system to obtain the consistent power electricity produced.
- e) The design of traffic light is focused on traffic signal at the junction for road vehicle.
 - Stop
 - Get ready
 - Go straight, turn right or turn left.

In briefly, the flow of methodology in this project is constructing the current sensor circuit; install the three flash LED and LCD display as the output of this system, design the layout of traffic light display by using Proteus software, install solar panel and battery as main power supply.

This report reveals about the introduction of the project, problem statement, objective, scope, literature review which related to this project and the method that will be used in this project. The result and analysis, discussion, conclusion and recommendation also will be exposed in this report.